

Radiation Safety Act 1999

RADIATION SAFETY STANDARD

NM001:2010

Standard for radiation apparatus used to carry out plain film radiography of inanimate objects

Preface

Under section 17 of the *Radiation Safety Act 1999*, a possession licensee who, under a licence, possesses an ionising radiation apparatus to carry out a radiation practice, must ensure that the apparatus is not used for this purpose, unless the radiation apparatus complies with the relevant standard.

This radiation safety standard NM001:2010 *Standard for radiation apparatus used to carry out plain film radiography of inanimate objects* is made under section 16 of the *Radiation Safety Act 1999*.

This standard sets the minimum safety criteria for radiation apparatus used to carry out plain film diagnostic radiography. Compliance with this standard will assist in ensuring that public and occupational exposure to radiation is minimised.

Queensland Health has prepared this standard based on information derived from reputable sources such as Standards Australia, New Zealand Standards, the National Council of Radiation Protection and Measurements and the National Radiation Laboratory.

The standard will be reviewed periodically to re-evaluate its currency and its appropriateness as the standard for radiation apparatus used to carry out plain film radiography of inanimate objects.

By ensuring compliance with this radiation safety standard, the standard of plain film diagnostic radiation apparatus in Queensland will be significantly enhanced.

I, Paul Lucas, Deputy Premier and Minister for Health, pursuant to section 16(1) of the *Radiation Safety Act 1999*, make the radiation safety standard NM001:2010 *Standard for radiation apparatus used to carry out plain film radiography of inanimate objects*, for the purposes of the Act.

SIGNED

PAUL LUCAS MP
Deputy Premier
Minister for Health

19 / 08 / 2010

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Standard for radiation apparatus used to carry out plain film radiographic imaging of inanimate objects

Section 1 – General

1.1 Scope

This radiation safety standard sets out the minimum requirements for ionising radiation apparatus that is used to carry out plain film radiography of inanimate objects such as phantoms and dummies

1.2 Expiry

This radiation safety standard expires on 1 September 2020.

1.3 Documents

Documents which may provide some useful information are listed in Appendix A.

1.4 Definitions

In this standard -

"coefficient of linearity" means the ratio of the difference between any two radiation output measurements to the sum of the same two measurements.

"coefficient of variation" means the ratio of the standard deviation to the mean value of a series of measurements.

"focal spot to image receptor distance" means the distance from the focal spot to the image receptor plane.

"image reception area" means the surface on which an X-ray pattern is received.

"image receptor plane" means the plane containing the greatest dimensions of the image reception area.

"kVp" means the potential difference, applied to an X-ray tube between the anode and the cathode, which is expressed by its peak value in kilovolts (kVp).

"leakage radiation" means ionising radiation which has passed through the protective shielding of a radiation source as well as that which, for some types of X-ray generators, has passed through the radiation aperture before and after loading (for example one containing a grid controlled X-ray tube).

"loading" means the act of supplying electrical energy to the anode of an X-ray tube.

"mA" means the electric current of the electron beam incident on the target of an X-ray tube, which is expressed by its mean value in milliamperes (mA).

"**mAs**" means the electric current of the electron beam incident on the target of an X-ray tube over a particular time, which is expressed by multiplying the mean value in milliamperes by the seconds (mAs).

"**radiation level**" means the air kerma radiation dose during a specified time.

Section 2 - Standard – Plain film radiography of inanimate objects

| Test | Compliance Test | Criteria for Passing the Test |
|--------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Radiation output</i> | | |
| 1 | Reproducibility | The coefficient of variation of 5 consecutive radiation output measurements at an exposure setting of approximately 70kVp, 200mA and 50 milliseconds, taken within a time period of 10 minutes, must not exceed 0.05. |
| 2 | Linearity | The coefficient of linearity between any two radiation output measurements from several exposures using the same kVp (approximately 70kVp) taken from the lowest to the highest mA/mAs values, within a time period of 10 minutes, must be less than or equal to 0.2. |
| 3 | kVp accuracy | The kVp accuracy, starting at the lowest kVp generally used and increasing in 10kVp steps until the maximum kVp generally used is reached, must be within ± 5 percent or ± 5 kVp, whichever is the lesser of the indicated value. |
| 4 | Timer accuracy | From several exposures at 70kVp and 100mA with time settings ranging from 10 milliseconds to 1 second in about 8 steps, the exposure time accuracy must be within: (a) ± 10 percent of the indicated value for exposure times greater than or equal to 0.1 seconds; and (b) ± 20 percent of the indicated value for exposure times less than 0.1 seconds. |
| 5 | Beam quality - half value layer | The total filtration must be such that the measured half value layers are equal to or greater than 2.3 millimetres of aluminium at 80kVp. |
| <i>Radiation level</i> | | |
| 6 | X-ray source assembly | The leakage radiation level must not exceed 1mGy in one hour at 1 metre from the focal spot with the X-ray tube operating at the maximum rated voltage and the maximum rated continuous current. |
| 7 | Capacitor discharge units – discharge mode | The leakage radiation level from capacitor discharge units in the discharge mode must not exceed 1.0mGy in one hour at 1 metre from the focal spot. |
| 8 | Capacitor discharge units – charge/preparation mode | The leakage radiation level from capacitor discharge units in the charge or preparation mode must not exceed 20 μ Gy in one hour at 5 centimetres from any accessible surface. |

| Test | Compliance Test | Criteria for Passing the Test |
|-----------------------------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Control panel | | |
| 9 | Hand switch cord – mobile | Where a hand switch is fitted to a mobile radiation apparatus, the hand switch must be at least 2 metres in length. |
| 10 | Indication if more than one X-ray tube | If more than one X-ray tube can be operated from the same control panel, there must be: <ul style="list-style-type: none"> (a) a signal at the control panel indicating the X-ray tube selected; and (b) a visible indication at or near the X-ray tube selected (not applicable in the case of enclosed under-couch tubes). |
| 11 | Exposure switches – protected | All exposure switches must be provided with mechanical devices to protect against accidental actuation. |
| 12 | Exposure switches - “dead-man” | Each loading must be initiated and maintained by means of a control requiring continuous actuation by the operator. |
| 13 | Loading indication | Loading in the intermittent mode must be indicated by an amber light and an audible signal. |
| Beam limiting device | | |
| 14 | Light field intensity | The illuminance of the light beam indicator must be greater than or equal to 100 lux at 1 metre from the focal spot of the X-ray tube. |
| 15 | X-ray/light beam alignment | (a) The extent of misalignment between any boundary of the light beam and the equivalent boundary of the X-ray beam in the plane of the image receptor must not exceed 1 percent of the focus to film distance; and <ul style="list-style-type: none"> (b) the central X-ray beam must coincide with the central light beam to within ± 0.3 degrees (for a 20 centimetre high beam alignment test tool, the top test object must be within 5 millimetres of the bottom test object). |
| Tube stability | | |
| 16 | X-ray tube stationary | The X-ray tube must remain stationary during loading unless it is intended to move. |

Appendix A

Documents

Australian/New Zealand Standard. *Approval and test specification - Medical electrical equipment - Part 1.3: General requirements for safety - Collateral Standard: Requirements for radiation protection in diagnostic X-ray equipment.* AS/NZS 3200.1.3:1996.

Australian/New Zealand Standard. - *Approval and test specification - Medical electrical equipment, Part 2.7: Particular requirements for safety - High-voltage generators of diagnostic X-ray generators.* AS/NZS 3200.2.7:1994.

Australian/New Zealand Standard *Approval and test specification - Medical electrical equipment, Part 1: Particular requirements for safety - Dento-maxillofacial X-ray equipment.* AS/NZS 3200.2.201:1996.

Health Department of Western Australia, *Diagnostic X-ray Compliance Testing Workbook.* 1996.

National Council on Radiation Protection and Measurements, *Quality assurance of diagnostic imaging equipment.* NCRP Report No. 99, Bethesda MD, 1988.

National Radiation Laboratory. *Code of Practice for the Use of X-ray in Medical Diagnosis.* 1994.